

## STRICTLY NONBLOCKING MULTICAST MULTI-STAGE NETWORKS

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### 5 ABSTRACT OF DISCLOSURE

A three-stage network is operated in strictly nonblocking manner in accordance with the invention includes an input stage having  $r_1$  switches and  $n_1$  inlet links for each of  $r_1$  switches, an output stage having  $r_2$  switches and  $n_2$  outlet links for each of  $r_2$  switches. The network also has a middle stage of  $m$  switches, and each middle switch

10 has at least one link connected to each input switch for a total of at least  $r_1$  first internal links and at least one link connected to each output switch for a total of at least  $r_2$  second internal links, where  $m \geq 2 * n_1 + n_2 - 1$ . In one embodiment, each multicast connection is set up through such a three-stage network by use of at most two switches in the middle stage. When the number of inlet links in each input switch  $n_1$  is equal to the number of

15 outlet links in each output switch  $n_2$ , and  $n_1 = n_2 = n$ , a three-stage network is operated in strictly nonblocking manner in accordance with the invention if  $m \geq 3 * n - 1$ . Also in accordance with the invention, a three-stage network having more middle switches than  $2 * n_1 + n_2 - 1$  is operated in strictly nonblocking manner even if some multicast

20 connections are set up by using more than two middle switches as long as each connection has available links into at least two middle switches and there are always at least  $n_1 - 1$  unused links from each input switch to middle switches, after each connection is set up.